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The Performance of Broiler Chickens Fed on Miana Plant Flour (*Plectranthus scutellarioides*, L.) R. Br.

Maria Endo Mahata[1*], Dwi Olina Putri[1], Arif[1], Takayuki Ohnuma[2], and Yose Rizal[1]

[1]*Nutrition and Feed Technology Department, Faculty of Animal Science, Universitas Andalas, Padang, Indonesia*
[2]*Department of Advanced Biosciences, Kindai University, 3327-204 Nakamachi, Nara 631-8505, Japan*

[*]Corresponding author's Email: maria@ansci.unand.ac.id; ORCID: 0000-0002-4692-9806

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ABSTRACT

The aim of the present study was to evaluate the effect of Miana plant flour (*Plectranthus scutellarioides*, L.) R. Br. in the diet on the performance of broiler chickens. The current study used 100 broiler chickens from day-old chicks, and a commercial diet was given up to seven days for the adaptation period. The present experiment was designed in a completely randomized design with five different levels of Miana plant flour (0, 5%, 7.5%, 10%, and 12.5%) in broiler chicken's diet as treatments (N = 20 bird/level), and each treatment was repeated four times. The diet was arranged iso-protein (21%) and iso-energy (2900 kcal/kg). Daily feed intake, daily weight gain, feed conversion ratio (measured every week and divided by seven to get daily data), Live weight, Carcass percentage with skin, Carcass percentage nonskin, and abdominal fat pad percentage were measured at the end of the study. The results showed that the inclusion of Miana plant flour in broiler chickens' diet significantly affected daily weight gain, live weight, feed conversion, carcass percentage with skin, carcass percentage except for skin while it did not affect daily feed intake and abdominal fat pad percentage. In conclusion, Miana plant flour can be used up to 12.5% in the diet non any negative effect on broiler chickens' performance.

Keywords: Abdominal fat pad percentage, Broiler, Carcass quality, Miana plant, Performance

INTRODUCTION

The utilization of antibiotics as feed additives in animal feed industries has been banned in many countries, including in Indonesia. Evaluation of pathogenic bacteria in feed added with antibiotics found that there is bacterial resistance to antibiotics that can spread to other microbes; therefore, several countries have banned the use of antibiotics in feed (Selaledi et al., 2020). Indonesia is rich in medicinal herbs, specially Miana plant (*Plectranthus scutellarioides*, L.) R. Br. This plant belongs to the *Lamiaceae* family.

Miana plants in Indonesia are known as jawer kotok, and it is included in 66 biopharmaceutical plant commodities according to the Decree of the Minister of Indonesian Agriculture, Number 511/Kpts/PD.310/9/2006 (Salim and Munadi, 2017). According to Auliawan and Cahyono (2014), Miana plant leaf extract contains an alkaloid, flavonoid, saponin, tannin, and is negative for steroid tests. Flavonoid and saponin supplementation is reported to increase growth, feed efficiency, and meat quality of non-ruminant livestock (Miah et al., 2004; Magdalena et al., 2013). Providing the optimal amount of tannin (up to 1%) can inhibit pathogenic bacteria's growth (Hughes et al., 2005). Furthermore, the ethanol extract of the Miana plant was also reported as an anti-bacterial agent (Mpila, 2012). Miana plants contain 84.5% water, 15.5% dry matter, 14.96% crude protein, 21.09% crude fiber, 10.18% crude fat, 13.6% ash, 1.357.39 kcal/kg energy metabolism, and 206.40 ppm anthocyanins (Laboratory of Non-Ruminant Livestock, 2019; Laboratory Post-Harvest Agricultural Development, 2019).

Previous researchers have reported that the use of various types of Miana as feed ingredients and as feed additives for broilers could create a dense carcass texture, increased body weight gain, reduced ration conversion, and did not interfere with broiler performance (Praptiwi and Indriastuti, 2015; Fati et al., 2019; Fati et al., 2020). The present study was carried out to examine the effect of Miana plant flour in the diet of broiler on their performance characteristics.

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MATERIALS AND METHODS

Ethical approval

All stages of the research were carried out following the guidelines laid by the institutional ethics committee for the care of animals and was approved by the Animal Ethics Committee of the Universitas Andalas, Padang, Indonesia, with number: 439/UN.16.2/KEP-FK/2021.

Experimental broiler chickens

One hundred male day-old broiler chickens strain Arbor Acres CP-707 were used in the experiment. The samples were bought from one of the poultry shops in West Sumatra Province, Indonesia.

Experimental design

The present experiment was conducted in a Completely Randomized Design (CRD) with different Miana plant flour levels as treatments (0, 5%, 7.5%, 10%, and 12.5%) in the diet and each treatment was repeated four times. Miana plant flour was mixed with other feed ingredients according to the predetermined treatment level until homogeneity and became the treatment diet in this study.

Experimental diet

The experimental diet was self-prepared, with the following ingredients; soybean meal, meat flour, yellow corn, coconut oil, Bravo CP 511 (commercial diet), top mix, Miana plant flour (*Plectranthus scutellarioides*, L.) R. Br. (Table 1). Experimental diet composition (%) of broiler for treatment A (53.50 yellow corn; 10.00 soybean meal; 00.00 coconut oil; 14.00 meat flour; 2.50 top mix; 00.00 Miana plant flour; and 20.00 Bravo Cp 511), B (48.75 yellow corn; 9.50 soybean meal; 0.75 coconut oil; 14.00 meat flour; 2.50 2.00 top mix; 5.00 Miana plant flour; and 20.00 Bravo Cp 511), C (46.75 yellow corn; 9.00 soybean meal; 1.25 coconut oil; 14.00 meat flour; 1.50 top mix; 7.50 Miana plant flour; and 20.00 Bravo Cp 511), D (44.75 yellow corn; 8.50 soybean meal; 1.75 coconut oil; 14.00 meat flour; 1.00 top mix; 10.00 Miana plant flour; and 20.00 Bravo Cp 511), and E (42.75 yellow corn; 8.00 soybean meal; 2.25 coconut oil; 14.00 meat flour; 0.50 top mix; 12.50 Miana plant flour; and 20.00 Bravo Cp 511) was calculated. Experimental diets were formulated as iso-energy (2900 kcal/kg), and iso-protein (21%). The treatment diet was given in the form of flour to broilers. Miana plant flour was introduced to chickens from the age of 2-7 days (adaptation period). Furthermore, Miana plant flour was added to the broiler diet according to the predetermined levels (0, 5%, 7.5%, 10%, and 12.5% in the experimental diet) starting at 8-35 days.

Table 1. Experimental diet composition, diet nutrient content, and metabolizable energy of broiler chickens

Feedstuffs (%)	Experimental diets composition				
	A	B	C	D	E
Yellow corn	53.50	48.75	46.75	44.75	42.75
Soybean meal	10.00	9.50	9.00	8.50	8.00
Coconut oil	0.00	0.75	1.25	1.75	2.25
Meat flour	14.00	14.00	14.00	14.00	14.00
Top mix	2.50	2.00	1.50	1.00	0.50
Miana plant flour	0.00	5.00	7.50	10.00	12.50
Bravo Cp 511	20.00	20.00	20.00	20.00	20.00
Total	100.00	100.00	100.00	100.00	100.00
Diet nutrients content (%) and metabolizable energy (kcal/kg)					
Crude protein	21.30	21.40	21.36	21.32	21.28
Crude fiber	3.19	4.12	4.58	5.05	5.51
Crude fat	4.05	5.13	5.80	6.47	7.15
Calcium	0.73	0.75	0.76	0.76	0.77
Available phosphorus	0.36	0.37	0.38	0.38	0.38
Metabolizable energy	2992.75	2948.94	2944.58	2940.21	2935.85
Lysin	0.22	0.20	0.17	0.14	0.12

Preparation of Miana plant flour

Miana plants were obtained from several locations in West Sumatra Province. Miana plant was harvested by pruning 25 cm heights from the soil's surface. Miana plants were cleaned and dried in an oven at 60^{o}C until the water content reached 14%, then mashed. Furthermore, Miana plant flour was ready to use for poultry feed (Modified method of Bradley, 2010)

The measured parameters

Daily feed intake

It was calculated according to the method by Ojediran et al. (2017); the total amount of feed provides (g) to the broiler minus the total amount of leftover feed (g) by broiler and divided by 28 days (experiment period).

Daily weight gain

It was calculated by the method of Ojediran et al. (2017); broiler chickens' body weight (g) at the end of the experiment period minus initial broiler body weight (g), and was divided by 28 days (experiment period).

Feed conversion

It was calculated according to the method of Ojediran et al. (2017); feed consumption (g/bird/day) divided by body weight gain (g/bird/day).

Live weight

The live weight of the broiler chickens was obtained by weighing the live weight before being slaughtered (g) at the end of the experiment, which was previously fasted for 10 hours Ralahalu et al. (2020) by doing a minor modification.

Carcass percentage with skin

It was calculated by the method of Gopinger et al. (2014) by doing a minor modification. Carcass with the skin of broiler chickens was weighed (g), and then divided by live broiler weight (g), and multiplied by 100%.

Carcass percentage non-skin

Carcass non-skin of the broiler chickens was calculated according to Gopinger et al. (2014) by doing a minor modification. It was weighed at the end of the study (g), and then divided with live broiler weight (g), and multiplied by 100%.

Abdominal fat pad percentage

It was calculated by the method of Jimenez-Moya et al. (2021). The abdominal fat pad was weighed (g), and divided with live weight (g), and then multiplied by 100%.

Statistical analysis

All data obtained in the current study were processed statistically by analysis of variability. The differences among treatments would continue analysis with Duncan's Multiple Range Test (DMRT) (Steel and Torrie, 1991) The difference among treatment means was determined by using Duncan's multiple range test ($p < 0.05$).

RESULTS AND DISCUSSION

Analysis of the Daily Feed Intake (DFI), Daily Weight Gain (DWG), Feed Conversion Ratio (FCR) is shown in Table 2. In addition, Table 3 presents the live weight, carcass percentage with skin, Carcass percentage nonskin, and abdominal fat pad percentage. Miana plant flour did not affect broiler chickens' DFI ($p > 0.05$) significantly, while it affected daily weight gain and feed conversion ($p < 0.05$) significantly. Furthermore, the inclusion of Miana plant flour in the broiler chickens' diet significantly affected carcass percentage with skin and carcass percentage non-skin ($p < 0.05$), however, it did not affect abdominal fat pad percentage ($p > 0.05$). The broiler chickens' live weight did not affect by Miana plant flour with the level of confidence ($p > 0.05$, Table 3).

Table 2. The average daily feed intake, daily weight gain, and feed conversion ratio of broiler chickens fed with treatments diets containing different concentrations of Miana plant flour

Treatments (Miana plant flour) (%)	Daily feed intake (g/bird/day)	Daily weight gain (g/bird/day)	Feed conversion ratio
A (0)	93.50	46.49^{b}	2.01^{a}
B (5)	94.68	50.83^{a}	1.87^{a}
C (7.5)	93.96	51.82^{a}	1.82^{ab}
D (10)	93.41	52.14^{a}	1.80^{ab}
E (12.5)	87.76	55.17^{a}	1.60^{b}
SE	2.03	1.41	0.07
p value	0.05	0.05	0.05

A: 0% of Miana plant flour in broiler chicken's diet; B: 5% of Miana plant flour in broiler chicken's diet; C: 7.5% of Miana plant flour in broiler chicken's diet; D: 10% of Miana plant flour in broiler chicken's diet; and E: 12. 5% of Miana plant flour in broiler chicken's diet, SE: Standard Error. Different lowercase superscripts in the same column show a significant effect ($p < 0.05$)

Table 3. The average live weight, abdominal fat pad percentage, carcass percentage with skin, and carcass percentage non skin of the broiler chickens fed with treatment diets, which contains different levels of Miana plant flour

Treatments (Miana plant flour) (%)	Live weight (g/bird)	Carcass percentage with skin (%)	Carcass percentage non skin (%)	Abdominal fat pad percentage (%)
A (0)	1.450.00	67.71^{c}	60.46^{b}	1.53
B (5)	1.502.00	71.15^{bc}	64.85^{b}	1.46
C (7.5)	1.645.75	72.84^{abc}	64.93^{b}	1.26
D (10)	1.591.50	77.20^{ab}	71.22^{a}	1.37
E (12.5)	1.698.50	79.00^{a}	72.70^{a}	1.29
SE	63.78	2.23	1.95	0.10
p value	0.10	0.5	0.5	0.5

A: 0% of Miana plant flour in broiler chicken's diet; B: 5% of Miana plant flour in broiler chickens' diet; C: 7.5% of Miana plant flour in broiler chicken's diet; D: 10% of Miana plant flour in broiler chicken's diet; and E: 12.5% of Miana plant flour in broiler chicken's diet, SE: Standard Error. Different lowercase superscripts in the same column (carcass percentage with skin and carcass percentage non-skin) show a significant effect ($p < 0.05$).

Increasing the level of Miana plant flour up to 12.5% in the broiler chickens' diet changed the diet's color from yellowish to slightly dark brown. The discoloration of diet was caused by changing diet composition by reducing corn utilization replaced by Miana plant flour in the diet. The Miana plant flour has anthocyanin with red color, and it affected the diet color. The discoloration of the diet did not reduce palatability for the broiler chickens. According to Situmorang et al. (2013), poultry does not like the diet with dark color, and they more prefer the diet with light color. However, the inclusion of Miana plant flour in the present study did not affect feed consumption even though its color was changed from yellowish to slightly dark brown. This condition was contrary to the obtained results of a study conducted by Situmorang et al. (2013).

The inclusion of Miana plant flour in the diet could increase the DWG of the broiler chickens which is due to the Miana plant flour containing ethanol compounds which are anti-bacterial, especially *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas naeruginosa* (Mpila, 2012). The digestive tract condition will be healthier so that the digestion process and absorption of food substances would be optimal. Furthermore, Auliawan and Cahyono (2014) stated that Miana plant leaf extract contains an alkaloid, flavonoid saponin, tannin. Flavonoid and saponin supplementations were reported to increase growth, feed efficiency, and meat quality of non-ruminant livestock (Miah et al., 2004; Magdalena et al., 2013). Providing the optimal amount of tannin (up to 1%) can inhibit pathogenic bacteria's growth (Hughes et al., 2005).

In the present study, the inclusion of Miana plant flour up to 12.5% in the broiler chickens' diet produced the best FCR. The feed conversion ratio is a reflection of the efficiency and quality of the diet in producing broiler meat. By increasing the level of Miana plant flour up to 12.5% in the diet, the FCR of broiler chickens was better than the control group, and the groups with lower levels of feeding Miana plant flour (5%, 7.5%, and 10% in diet). This is due to the active substance content of Miana plant flour at a level of 12.5% higher than the level (5%, 7.5%, and 10%) of Miana plant flour in the diet. Active substances such as flavonoid, saponin, tannin, essential oil, eugenol, polyphenol compound, alkaloid, ethyl salicylate, calcium oxalate, rosmarinic acid compound were active compounds as an antimicrobial that can kill pathogenic microorganisms such as *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas naeruginosa* (Nugroho, 2009; Mpila, 2012). Thus, the active compounds can improve digestion and absorption of food substances better than other treatments. The FCR decreased using 12% Miana plant flour in the broiler's diet. The low FCR value indicated that the diet used is more efficient (Lengkong et al., 2015). Fati et al. (2020) also found that the inclusion of Miana (*Coleus atropurpureus* [L.] Benth.) leaf extract through the drinking water at a level of 0.075% decreased FCR and increased BWG of the broiler chickens.

The inclusion of Miana plant flour in the diet did not affect broiler live weight. The active substances in Miana plant flour in the diet will suppress pathogenic bacteria's growth and increase the bacteria that are useful for the body in the digestive tract of broilers, thus it results in the increased digestibility and absorption of feed nutrients. Thus the provision of Miana plant flour is still able to maintain broiler live weight. The same thing was also reported by Malvin et al. (2021), the inclusion of fermented Miana in broiler's drinking water did not affect live weight, and after the dose was increased to 8 ml/L live weight increased; however, the increase was not significant.

The active substances in Miana plant flour in the diet will suppress pathogenic bacteria's growth and increase the bacteria that are useful for the body in the digestive tract of broilers, thus it results in the increased digestibility and absorption of feed nutrients. Ridwan et al. (2006), reported that secondary metabolites, such as alkaloids and steroids found in *Coleusblumei* Benth's Miana plant have anthelmintic activity.

The highest broiler carcass percentages with skin and non-skin in the present study were found when Miana plant flour inclusion reached the level of 12.5% in the diet. The carcass percentage with skin tended to increase in the inclusion of Miana plant flour at the levels of 7.5%, 10%, and 12.5% in the diet; meanwhile, the carcass percentage of broiler non-skin increased when the broiler chickens fed Miana plant flour 10% and 12.5%. Live weight and abdominal fat pad percentage were positively correlated with the percentage of a carcass. Inclusion of Miana plant flour 12.5% in the broiler chickens' diet resulted in a higher live weight than the live weight of the chickens that did not consume Miana plant flour, therefore, at the level of 12.5% yields the higher carcass broiler percentage with skin and non-skin. According to Nahashon et al. (2005) and Subekti et al. (2012), there is a strong correlation between live weight with carcass weight; the higher of live weight produced, the higher carcass weight, and vice versa.

The inclusion of Miana plant flour in the broiler chickens' diet did not affect the abdominal fat pad percentage. It was related to large amounts of broiler abdominal fat pad percentages not formed at the age of five weeks because broilers are still growing and require

growth. Thus, the energy consumed from each treatment of Miana plant flour in the diet can be utilized by the broiler chickens' body, and not much stored as the energy that is not utilized in the abdominal fat pad. According to Pratikno (2011), fat tissue in poultry begins to form rapidly at the age of six to seven weeks, and fat accumulation continues, especially abdominal fat at the age of eight weeks, so that broiler chickens' body weight increases rapidly.

CONCLUSION

Miana plant flour can be used as a broiler's feed-in diet non a negative effect on their performance. It is necessary to cultivate Miana plants for their continuous availability as poultry feed ingredients.

DECLARATIONS

Competing interests

All authors declare that they have no competing interest concerning the work presented in this manuscript.

Authors' contributions

Maria Endo Mahata participated in all stages of the research, namely the research design, the conduct of the experiment, sample analysis, data analysis, writing, and editing of articles. Dwi Olina Putri participated in conducting the investigation, Arif was responsible for data analysis. Takayuki Ohnuma and Yose Rizal participated in the research and design editing of articles. All authors participated in writing the article and checking the statistical analysis and finally approved the last version of the article for publishing.

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Ethical considerations

Plagiarism, consent to publish, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been checked by the author.

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